SMALL FARMERS' PARTICIPATION IN THE DESIGN OF TECHNOLOGIES: A "state of the art" review

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INTRODUCTION

Small farmers in developing countries are often bypassed by the technology generation process. The lack of effective research for tackling the complex problems of adapting available technology to the highly diverse condition of small farmers means that many recommendations fail because farmers find them inappropriate to their needs and resources.

Substantial investments have been made in agricultural research that fails to reach small farmers. It is common to observe well-equipped experiment stations with modern agricultural techniques, literally surrounded by small farmers who grow the same crops using traditional technology. One reason for this is that small farmers in developing countries lack the organization to communicate their needs to technology designers, or to ensure that these needs are addressed when research agenda are planned and when resources for research are allocated.

To bridge this gap, efforts were initiated in the late seventies to bring researchers to the farmers' fields by conducting on-farm research or farming systems research. This effort has not, however, systematically involved small farmers as active participants in the planning, execution and evaluation of research. In particular, the concept of farmer participation in <u>planning</u> research has been neglected. Farmers usually participate in on-farm testing, either with a nominal presence as the grantor of land for experiments or, at best, as physical participants in implementing production operations for on-farm trials. When as a result, research conducted in farmer's fields is initiated and controlled completely by scientists, it merely constitutes a test of technological components in the physical environments of farms.

Knowing your clients and designing a program to meet their needs is an important management concept to which bureaucratic public service research organizations run by agricultural scientists have not been attuned in developing countries. Participatory management has been tried in other fields such as community health delivery systems, for example; but such techniques have yet to be applied to the management of agricultural research, where client involvement in the generation of technology is as critical as participation in the delivery system (i.e., extension system).

Conventional on-farm research or faming systems research methodologies have not come to grips with the need to institutionalize farmer-scientist collaboration in the planning, testing and evaluation of technologies. In developing countries the intellectual, cultural and social gap between the professional scientist based on an experiment station and the small farmer is great. It is difficult for agricultural scientists to conceive how semiliterate, barefoot farmers can participate in research, and to voluntarily involve farmers in the intellectual process of defining problems, setting priorities and identifying potential solutions.

Yet small farmers are active in the difficult task of adapting agricultural technology to the location-specific conditions of their farming environment. In every farming community, there exist innovative farmers who try out new farming techniques in an informal process of research and development called "farmer experimentation". In developed countries early efforts at agricultural technology generation were based on exploiting the knowledge of the best farmers and in promoting a process of horizontal transfer; that is, farmer-to-farmer innovation. In contrast, agricultural scientists in developing countries are trained to manage agricultural innovation as a process of vertical transfer; i.e., bringing in foreign technologies, adapting and transferring them to farmers. The initiative and indigenous technical knowledge embodied in farmer experimentation are valuable resources that remain untapped by technology development and transfer institutions. An important reason for the neglect of small farmer expertise is the lack of a formal methodology providing agricultural scientists with techniques for implementing farmer participation in ways that enable small farmers to utilize their expert knowledge of local conditions, their skills and their capacity for self-help.

This chapter discusses the issues of farmer participation by addressing three basic questions:

1. Why should small farmers participate in technology design? What are the benefits, both expected and observed, of farmer participation?

2. When should small farmers participate? What are the stages in technology design for agriculture when small farmers can make an input?

3. How can small farmers participate? What are the approaches, and practical techniques that are being developed and tested in field conditions to involve farmers in technology design?

Although farmer participation is increasingly recognized as an important principle for achieving adoptable technologies, practical implementation of farmer participation is at present an experimental and innovative field of endeavor. The chapter concludes with a brief discussion of the gaps in present knowledge, and suggestions for future work.

THE BENEFITS OF FARMER PARTICIPATION IN TECHNOLOGY DESIGN

In its present stage of development, farmer participation research focusses on a major problem faced by adaptive research for small farmers: how to cater for the enormous diversity of location-specific needs and constraints of this client group in technology design.

Six major areas of potential impact or benefit can be identified from the literature on farmer participation as reasons for adopting a participatory approach to technology design for agriculture:

- Improving researchers' understanding of small farmers' needs toward better definition of research problems for adaptive (on-farm) research.

- Integrating indigenous technical knowledge and local innovations into adaptive research.

- Improving feedback about farmers' needs and objectives to orient applied (experiment-station) research.

- Accelerating transfer and adoption of improved technology among small farmers.

- Achieving cost-effectiveness and more efficient use of scarce human resources in on-farm research, through better linkages among farmers, researchers and extensionists.

- Developing organizational models, professional skills and values appropriate for demand-driven, problem-oriented technology design.

Concrete evidence and experience as to the achievement of these benefits is for the most part restricted to the first three areas: improved problem definition, linkages between indigenous technical knowledge and formal scientific research, and feedback to orient applied research. To some extent, this reflects the innovative state-of-the-art in participatory research with small farmers: the majority of projects or programs reporting experiences with farmer participation in technology design are in the early stages of diagnosis and experimentation; few report results in terms of adoption; as yet almost no effort has been dedicated to documenting costs and time requirements. Moreover, the bulk of participatory research has occurred outside of national agricultural research programs in developing countries (in non-government supported projects, international agricultural research centers or universities) so that little is known about the costs or organizational requirements of farmer participation research in formal institutions on any appreciable scale.[1] (p.64)

Technology design with farmer participation has been implemented in a number of different types of technology. Although most of the reported examples refer to the selection of genetic materials, there are instances of farmer participation in livestock and agroforestry research, in fertilizer research, in crop, soil and water management, in crop storage, and home gardens.[2-9] These experiences suggest that farmer participation has a high payoff for researchers working for client groups in small-farm systems which have evolved finely-tuned adaptations to difficult local agro-climatic and edaphic conditions and resource constraints to meet specific needs. Local knowledge of these systems typically exceeds scientists' understanding of them.

An illustration is the traditional "bensani" system of weed management in India discussed by Maurya and Bottrall.[10] In the "bensani" system, 25-30 day-old rice is ploughed crosswise and planked to control a mayor weed (the Echinochoa species) which is identical to the rice plant in its early stages of development. The weed plant develops internodes within 30 days, so that there are weak points just below the nodes which cause the weed shoots to break and detach during planking. The rice plant does not develop such notes and internodes, and thus escapes breaking: during planking the rice bends and subsequently resumes its original erect position. Besides weed management, this practice ensures better water retention in the field and promotes tillering of the rice plant. The "bensani" technique is one of many farmer practices originally criticized by scientists, but which are being integrated into station and on-farm research as a result of efforts to involve farmers in the breeding and selection of varietal materials.[10] One of the major advantages of farmer participation is the integration of farmers' expertise in the management of their local system into the process of adapting new technology components into this system.

Much more challenging however, is the situation where traditional management practices and knowledge about the local system are decreasingly viable because the system is breaking down or in disequilibrium. This situation is typical of areas where increased population pressure, deforestation, soil erosion, over-grazing and depleted soil fertility imply that small farmers will have to make major system-level changes in order to sustain a viable agriculture. An example from Zambia illustrates how farmers' own experimental initiatives to intensify a traditional shifting cultivation system provided an important foundation for the design of new technologies for testing on-farm and on-station.[6] The traditional chitemene system in North-east Zambia involves the felling and harvest of woody vegetation from a plot, followed by burning the collected wood on a sub-plot, which is cultivated in a six-year rotation. The plot is then left in fallow for several years. The trend is towards shorter fallows and sharp declines in productivity. One focus of agricultural research has been to replace the chitemene system with high-input maize-based systems of permanent cultivation which however, were being adopted only by wealthier farmers. Study of other farmers' practices identified farmer experimentation with mounding as a way of incorporating plant biomass into the soil in the latter part of the traditional crop rotation, to prolong the useful life of the plot for bean or cassava production. Mounds were also being used by farmers as a conscious soil conservation practice for cultivating slopes. Mounding techniques developed by farmers were integrated with agroforestry research to incorporate trees providing high nutrient leafy biomass for mounding.

More effective adaptive research oriented to farmers' problems which incorporates indigenous technical knowledge, builds linkages with farmer experimentation and generates rapid feedback to technology designers, is the result of farmer participation to date. Achieving these benefits depends critically on the stage of technology design when small farmer participation is introduced.

FARMER PARTICIPATION IN DIFFERENT STAGES OF TECHNOLOGY DESIGN

In applied agricultural research, technology design usually proceeds through several different stages which can be broken out as follows:

1. DIAGNOSIS: Identification of objectives, needs and problems.

2. PLANNING: Setting priorities among problems, definition of potential solutions and formulation of strategy to test solutions.

3. DESIGN of prototype technology.

4. EXPERIMENTATION to test and evaluate prototype technology, resulting in developed technology.

5. VALIDATION of developed technology, resulting in recommendations for use.

These different stages may be carried out both on experiment stations and on farms. When farmer participation is implemented in on-farm or farming systems research, it normally occurs in the diagnostic stage, when problems are identified, and subsequently in the stage of validating results and developing recommendations.

In order to analyze farmer participation in this process, it is important to distinguish among different types of farmer participation in technology design.[2]

- Nominal farmer participation occurs when the farmer's role is a passive one. The farmer is involved in research as a respondent to structured diagnostic questionnaires, designed, administered and analyzed by researchers; or as a collaborator contributing land and labor to on-farm trials designed and managed entirely by researchers, who also derive conclusions from trials without attempting to interact with farmers about their responses to the technology.

- Consultative farmer participation is a type widely espoused by farming systems research. Diagnostic research involves informal interactions between researchers and farmers to identify problems to be addressed in technology design. Priorities among problems, further planning and design (stages 2, and 3 outlined above) are decided by researchers (though it may include extensionists).[11] Experimentation usually involves researcher-managed trials of the type described above, often carried out to perform an initial screening of prototype technology on-farm. Subsequently, the technologies that emerge from this initial screening are validated in "farmer-managed" trials.

Such trials can be more properly thought of as research-designed and farmer-implemented trials because researchers determine concepts in the design of the technology to be tested, and what changes in the farmers' existing practices or system are to be implemented.[2,12] Farmers' adoption of the technology is usually measured. Farmers opinions about the new technology may be sought during the validation stage of research.[13]

- Collegiate or decision-making farmer participation, so termed because the farmer is an active participant placed squarely in the role of a colleague in the research process. The farmer acts not as a passive object who is studied and measured; but as a subject who studies, measures and intervenes in making decisions about the technology through participation in planning, design and experimentation, as well as in diagnosis and validation.[2,14,15]

Nominal farmer participation characterizes a technology design process, now widely criticized, which transfers the experiment station to farmers' fields when consultative farmer participation is implemented, it usually occurs in the diagnostic stage, when problems are identified, and later in the validation stage when recommendations are developed. Collegiate farmer participation involves farmers and scientists in planning, design and experimentation as well as diagnosis and validation: efforts to involve farmers in these stages have developed in response to dissatisfaction with the consultative approach.[16,17]

Consultative farmer participation has two major shortcomings related to the stage at which hands-on involvement of farmers in technology design is activated in this approach. Although farmers participate early-on as informants and sources of ideas for problem diagnosis, the time-lag between identifying problems, designing potential tehnical solutions to farmers' problems (prototype technology) and obtaining farmers' reactions to developed technology during validation in farmer-implemented trials can be prolonged.[10]

Most applied agricultural research programs involve evaluation of a large number of alternative solutions to farmers' problems, be they plant varieties, planting densities, pest and disease controls, farm implements, livestock management practices or other components. These are screened selectively on-station and on farm by researchers to identify the most promising options (often termed the researchers' "best-bet"). By the time farmers participate in on-farm trials, many options have been discarded and farmers' responses are obtained to those few which appear most promising from the researchers' point of view. The risk entailed by this approach is that researchers may already have excluded from on-farm trials technological options which may appear promising from the farmers' point of view.

One reason for this is the widely-held assumption that farmer participation is only useful for validating "developed" technologies in farmer-implemented trials. Arguments in favor of this notion include shielding the farmer from risky experimentation; that multiple options are too difficult for farmers to evaluate so that trials should be kept simple and include only one or two new alternatives; and that farmers will lose confidence in research and extension services if many alternatives are seen to fail.[13,17]

A second shortcoming of consultative farmer participation is that as a technology becomes more developed (when for example, a set of cultural practices is evolved by on-station researchers and varieties are gradually selected for performance within this set of practices), it becomes more site-specific, and more specific to a sub-set of farmers' socioeconomic and cultural needs. The more developed, site and farmer-specific a technology, the more expensive it is to carry out adaptive research to fit the technology to farmer circumstances.[20]

Collegiate farmer participation originates from a different set of premises about the stages in technology design appropriate for involving farmers. The view that farmers are experimenters or researchers in their own right and that experiments should be jointly planned by scientists and farmers is central to this approach, and dates back to early advocates of on-farm and farming systems research.[21,22] Efforts to build a formal link with farmers' indigenous experimentation discussed earlier have involved farmers' in the early exploratory stages of screening technologies, when multiple options have been evaluated by farmers who made decisions about how to carry out the testing.[10,18,23,24]

An important objective of this work is to generate ideas for technology design which then guide applied on-station research. An example is the adaptation of potato storage research in Peru. Unlike station researchers, farmers did not perceive storage losses in terms of wastage, but identified their priority problem as a tendency of seed potatoes to sprout and lose weight during storage. Research objectives and technology design were re-oriented to develop seed storage methods which inhibit sprouting.[7]

Such experiences have prompted researchers to question the appropriateness of formal trial methods compared with indigenous experimentation, particularly with reference to varietal testing. For instance, can experiments be simplified to the extent of giving farmers planting material or training in a cultural practice, while researchers monitor farmers' opinions of varieties or adaptations of practices?[25,26]

Limited experience to date indicates that information retrieval by scientists can be difficult when farmers freely experiment with innovations, and that autonomous farmer experimentation may take a long time to arrive at reliable conclusions, in part due to slow rates of local seed multiplication in the case of varieties. Whether farmers are given the opportunity to make decisions about how to test technologies in formal trials or in free experimentation, the main thrust of this work has been to relax scientists' control over test parameters in order to generate better information about farmers'criteria for evaluating prototype technologies.

Farmer participation in planning, in setting priorities and in formulating strategy is viewed by some advocates as crucial to participatory research (otherwise considered a misleading title for technology generation that involves farmers, but is controlled by scientists). Participation in planning involves "explicitly enabling farmers themselves to identify what they want from scientists".[16] (p. 49)

An example of farmer participation in planning research for a farming system development project is reported by Lightfoot et al.[26] In this instance farmer meetings, farm visits for observation purposes and an informal survey were carried out to develop an analysis of problems with farmers and to enable farmers to arrive at a consensus about priorities for research. This process led researchers to study farmers' own experimental efforts to solve the priority problem. Experimental hypotheses were developed by farmers, elaborated by researchers in a debate with farmers, and resulted in tests carried out with farmers of several alternative (or prototype) solutions to the problem.

In this participatory planning process, researchers are shown to act primarily as facilitators, stimulating farmers to exchange ideas about a problem that they perceive as important, and to identify important principles for solving the problem.

Researchers assisted farmers to integrate and systematize their own efforts to find solutions and provided new inputs (in this example new legume species) critical to the successful application of principles for solving the problem identified by farmers.

Another example involving farmers in planning research is the Agricultural Technology Improvement Project (ATIP) in Botswana.[5] Farmer groups were formed initially as a method for trial management and in order to create an opportunity for on-going dialogue about farmer problems and opportunities. At village meetings, the full range of technology options available for testing were presented to farmers and discussed by them. Farmers selected which options they wanted to test. Monthly meetings were held after trial establishment to discuss progress, problems and farmers observations. In this "options-testing" process, the initial definition of trials was determined by farmers, resulting in a larger variety of trial types than had been defined by researchers on their own[5] (p.7).

An important issue raised by participatory planning and design with farmers is the degree of researcher initiative desirable in this process. The researcher has specialized technical knowledge of potential technical innovations about which farmers can have little or no knowledge, and can make suggestions which can broaden the scope of farmers' ideas, visions or hopes for the future. Farmers can identify and prioritize problems and potential solutions within the scope of their existing knowledge and experience, but how useful is this knowledge for planning research in situations where traditional knowledge is decreasingly viable?[1]

One response to this challenge is to present farmers with multiple options in the exploratory stage of technology design. It has been argued that farming systems are a "moving target" and that technology design must build upon dynamic trends in existing systems.[10] One of the findings of the ATIP Project was that some trials identified by farmers who took part in selecting options, represented a substantial change from their traditional system.[8] Other experiences indicate the importance of exploring with farmers their vision of "futures possible" or alternative future uses of their land in participatory diagnosis.[6] In one example, important new breeding objectives were identified by asking farmers to describe and explain the desirable characteristics of an "ideal" new variety, which had not been identified when farmers were only asked to react to existing varietal options developed by breeders.[15] Participatory research has the potential to involve farmers in the development of new farming systems by enabling farmers and scientists to interact about the potential of innovative prototype systems.

Evidence to date of the results of involving farmers in identifying what they want from scientists is severely limited, at least in published sources, but experience suggests that farmer participation in planning and design of prototype technologies requires that the stages (1 to 5) of technology design outlined above become greatly compressed in time. A relatively rapid interactive process is initiated once scientists become involved with farmers in dialogue about scenarios for prototype technologies.

An important principle of farmer participation in technology design is therefore, to give the user the opportunity to evaluate options; this requires early hands-on testing and adaptation of prototype technology by all parties concerned. As a result, on-farm testing ceases to function as only a process for validating technology conceived of and prescreened by scientists on their own. Instead, on-farm testing becomes an integral part of a rapid cycle of diagnosis-design-experimentation-feedback involving an exchange of ideas between farmers and scientists who are often based on experiment stations. This has important implications for methodology, which are discussed in the following section.

The earlier in the technology design process that farmer participation can be mobilized, the more likely it is that farmers' and researchers' ideas about desirable features of a technology will co-incide. It is worthwhile, therefore, to consider at what stages in a research program information about farmers' reactions to proposed alternatives could make a difference to the design of technology within the following framework:

1. Early evaluations of multiple alternatives. Farmer participation in pre-screening options at this stage can help researchers to sort out the "very good" and "very bad" options from the farmers' point of view. Even though researchers are likely to be concerned with broad adaptability at an early stage in the technology design process, while farmers are concerned with site-specific criteria, there is evidence that small farmers who share broadly comparable objectives and resources will identify desirable characteristics of technology in common. On the other hand, farmers with different resources may require different solutions to a similar problem. Farmer participation in pre-screening optional prototypes can help to fine-tune technology design to specific needs. Analysis of farmers' reasons for discriminating a good or bad technology can identify important objectives which should be considered in the early stage of technology design.

2. Comparisons of most promising alternatives. At a stage in research when a few alternatives to farmers' current technology have been identified, farmer participation can be implemented to determine not only what prototypes farmers perceive as most or least promising, but the specific reasons why one alternative is more, or less appealing than another to farmers.

3. Evaluation of developed technology. Farmer participation in evaluating developed technology can be an important diagnostic tool and a means of initiating farmer-scientist dialogue. At this stage in the research process, the objective of farmer participation can be to test (not just validate) the best available option, as a vehicle for identifying its advantages and/or shortcomings, and to start a cycle of participatory diagnosis, planning and design.

METHODS FOR FARMER PARTICIPATION IN TECHNOLOGY DESIGN

The disquiet among farming systems practitioners about the effectiveness of consultative farmer participation for communicating with small farmers about technology design means that many participatory research methods are being developed within the broad framework of farming systems research methodology. There is as a result an unfortunate tendency to classify as "participatory" any method which involves researchers in talking to farmers. A more precise definition requires participatory research methods to involve farmers in exercising some significant degree of control over what data is collected, and to what purposes or objectives it is analyzed (ie. over the definition of relevant criteria for evaluating research results). A few published resources on farmer participation research are explicitly concerned with methods for enabling farmers to collect data and do their own research (see Bunch, 1987, and Villarreal, 1987).[3,27]

There are however, some emergent principles underlying the application of the many, different methods being generated by practitioners of participatory research in agriculture. These principles are appled to data collection at various stages in technology design, reflecting the tendency to collapse conventional stages of research into a dynamic, iterative process of diagnosis-design-and-adaptation of technology with farmers. In general, participatory research methods are:

- Interactive, emphasizing immediate two-way information flows between the farmer-researcher/extensionist, and in farmer-to-farmer information exchange.

- Flexible, tending to minimize researchers'-control and maximize farmers' intervention in research design.

- Multiple, such that different techniques are applied simultaneously or overlapping in time (rather than sequentially).

- Rapid, to maximize ability to respond to farmer initiatives or unanticipated areas of research.

Considerable emphasis has been placed on the development of procedures for improving the quality of farmer-scientist interaction in the diagnostic stages of farmer participation research. Techniques or methods such as studies of farmer experimentation, histories of local technological change, future scenarios of farmers, farmer taxonomies, teaching by farmers, mapping farmers' fields or systems diagramming with farmers focus on face-to-face communication and seek to improve scientists' abilities to learn from farmers and thereby build on indigenous experimentation.[28] Many of these techniques have been developed for use in tandem with formal and informal survey methods, as a way of providing researchers with access to farmers' subjective terms of reference for analyzing farming systems.

All of the above mentioned approaches can be conducted with individual farmers, but the importance given to intensive interaction with farmers has led to increased emphasis on combining methods for individual participation with group work methods. Table 1 summarizes some of the advantages and disadvantages of group approaches to farmer participation. The major advantages refer to the improved quality of interaction with farmers, and increased efficiency in the use of staff time to sustain intensive communication with numbers of farmers. The disadvantages of working with farmer groups especially for diagnostic purposes refer to the potential for a group process to distort information, especially when researchers may be relatively new to the farming circumstances they are attempting to analyze with farmers.

Some of the problems encountered with group approaches are related to a methodological issue which has received relatively little attention to date in farmer participation research. That is: how to select which members of the farmer population should participate in technology design. This issue is equally important with respect to individual as well as group participation, but tends to be perceived as more problematic with respect to group formation, perhaps because the potential distortions or bias of information become more apparent through group dynamics.

An example is a technique for group diagnosis of farming problems, termed participatory diagnosis, which is applied to prioritize crops, cropping systems, and specific farmer problems developed by the Colombian Institute for Agricultural Research. [27] Community members attend group meetings on the basis of open invitation, so that groups form on the basis of self-selection. The meeting dedicates several hours to brainstorming in small groups about agricultural problems. Problems are then ranked in order of importance within small groups, and scored numerically to arrive at a plenary consensus about the problems of most interest to the community. This approach is extremely effective in obtaining information about which there is a broad consensus in the community, and generates a direct input by farmers planning. When however, a more detailed diagnosis of specific problems is required for planning research, the community self-selection method of group formation is found to mask information about the special needs or the priorities of

While methods for improving farmer-scientist interaction in the diagnostic stage have received considerable attention, much less effort has been devoted to systematizing techniques for involving farmers in planning, design and especially the analysis of experiments. In part, lack of attention to these aspects of farmer participation reflects the emphasis placed on farmers' manipulating, selecting and evaluating technological options in a trial framework free from the restrictions of formal experimentation.[9]

There is a need for statistical tests adapted to this type of "free" experimentation.[33] In participatory research with farmers, flexible experimental designs are used which dispense with controls for some factors. Others include large numbers of observations (sites) and imply high co-efficients of variation in experimental variables, to accomodate farmers' adaptation of prototype treatments to specific circumstances. An important concept is the "adaptive trial" which has various applications. In one example, adaptive trials are agronomic trials performed on-station and on-farm, which are based on farmers' own experiments adapted for statistical analysis.[24] In other cases, prototypes are laid out on a few farm sites, and are evaluated by individual farmers or by groups, allowing farmers to observe and select components for implementation on their own plots. This implementation can then be monitored.[34,35] Another approach to experimental design which has proved useful for testing genetic materials with farmers is to superimpose a trial consisting of several different materials on a large number of farmers' fields; each trial (farmer) represents a replication. Farmers freely adapt existing practices to the new varieties; and select varieties according to their own objectives.[36]

Farmer evaluations can be carried out in many different types of trial design. These evaluations can be quantified to provide researchers' with data on the relative importance of different criteria used by farmers to evaluate alternatives, as illustrated in Table 2.[37]

It will be particularly important for future participation research to address the issue of how farmers can take part in formal experimentation for two reasons. First, although the acid test of technology developed and tested with farmer participation is whether or not farmers adopt it, the credibility of participatory methods within the scientific community will also require compatibility with accepted methods of scientific verification. Second, and more important, one of the objectives of participatory research which as yet is receiving little systematic attention, is to strengthen indigenous or "free" experimentation so that farmers can take on increased responsibility for location-specific adaptive research. This unquestionably will require the development of methods for experimental design and analysis which can be learnt and implemented by farmers. To date, participatory methods for technology design stress improving scientists' ability to work with farmers. Future efforts must address the need to improve farmers' abilities to work with scientists.

CONCLUSIONS

Farmer participation research requires intensive interaction between farmers and scientists. One of the chief obstacles to realizing the potential benefits of farmer participation research is likely to be institutional. This includes the skills and values scientists and extensionists require in order to carry out participatory technology design with farmers. Organizational models for participatory research in agriculture have yet to be systematically worked out. Farmer participation in technology design requires a degree of decentralization and flexibility in the planning and execution of research which few formal agricultural research systems have yet evolved. Improved feedback to technology designers, greater complementarities and interchange of functions between researchers and extensionists, and mobilization of farmer and community resources for research purposes have all been observed in farmer participation research. The pay-off in terms of more focussed research-extension efforts and rapid adoption by farmers may be substantial. Future work must marshall the evidence.

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TABLE 1

ADVANTAGES AND DISADVANTAGES OF GROUP PARTICIPATION

Advantages	Disadvantages
. Group interactions stimulates discussion with and among farmers; may be productive of new ideas, of more reliable information.	. Groups can be dominated or inhibited, to produce false consensus and misleading information.
	. Farmers can become tired of time-consuming meetings
. Group interaction helps to motivate farmers and sustain interest.	. Low-status or reticent individuals may be inhibited from expressing themselves in a group.
. Groups provide a quick, efficient forum for assessing opinions held by a majority of farmers.	. Special interests or problems may fail to be identified in a group setting.
. Discussions of differences of opinion in a heterogenous group can help to refine research objectives, targets.	. Heterogenous groups which include competing interests or needs may become stalled and unable to analyze problems constructively.
. Groups can provide an overview of variable results from on-farm trials to interpret these; are useful for feedback of results to farmers.	. Forming homogeneous groups that represent user populations meaningful for research purposes may be logistically difficult or time-consuming.
. Ratio of staff-time to farmer-contact can be more efficient.	. Group membership may fluctuate on a given occasion or between meetings; consistency of information may be problematic
. Research-extension-farmer linkages can be maximized in in groups.	
. Groups can be used to evaluate results with types of farmers under-represented in on-farm trials.	

TABLE 2

FARMERS' CRITERIA FOR SELECTING DESIRABLE CASSAVA VARIETIES: CONTENT ANALYSIS OF THREE GROUP EVALUATIONS OF NINE VARIETIES, PESCADOR, CAUCA, COLOMBIA, 1987

Farmers' criteria	Frequency mentioned N	%
Starch content (quality for processing)	23	85
Fresh market quality[1]	22	81
Harvest date (earliness)[2]	17	63
Seed quality[3]	15	55
Plant architecture (foliage)[4]	12	44
Plant height	9	33
Easy to up-root	9	33
Distribution of roots[5]	7	26
Branching[6]	6	22
Resistance to pests	5	18

Notes:

[1] Medium-sized root, dark skin, pink epidermis, white flesh, dry (not watery) flesh.

[2] Size of roots, presence of new leaves indicating immaturity.

[3] Nodes close to each other; stake medulla white, not black; poor quality indicated by few nodes, widely separated, thickened stakes.

[4] Abundant foliage disliked, because difficult to enter plot to weed or harvest..

[5] Roots with short pedunculo preferred; roots with no pedunculo related to storage losses; roots with long pedunculo are difficult to harvest, causing lower yield.

[6] Low branching types disliked (difficult to weed); high branching types difficult to harvest.

Source: Ashby and Pachico (1987)